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I hope that the presentation of this subject at the present time may direct attention to these trees and that additional observations may be placed on record.

EXPLANATION OF PLATE LVII.

Fig. 1. Normal leaf of *Populus grandidentata*.

Fig. 2. Young sapling leaf of the same species.

Duct Formation in Chestnut Wood.

BY P. H. DUDLEY.

The large ducts in the inner portion of each annual ring of Chestnut wood are very conspicuous, attracting attention at once in the tranverse and radial sections. When cut slightly obliquely in the tangential section they form the beautiful and attractive contrast to the ordinary wood-cells which has long made the second growth of this wood so desirable for the interior finishing of cars, and, more recently, of houses. The large ducts form in one, two, and sometimes three quite distinct concentric rows in the early spring growth of each annual ring. The rings are not always alike in the same tree, owing to varying conditions of growth in different seasons, and marked variations are found in trees from different localities. Some of the ducts appear as soon as the wood-cells, being formed adjacent to the cells of the preceding year's growth, while others have only from one to three rows of cells between. In a specimen cut on May 1st, one row of ducts and eighteen rows of wood-cells had already formed. The leaves of this tree were only about one inch long and one-fourth of an inch wide, yet some of the ducts were of full size, well formed, having septa and well defined walls. In certain sections were found ducts evidently forming; they were small, but with distinct walls. Around these the wood-cells were of the usual shape and not much flattened, and the medullary rays not much bent out of their course. After comparing a number of more or less advanced ducts, it now seems to me that they increase in size by expansion instead of by absorbing the surrounding cells. If the formation of these ducts were a process of absorption, some of the medullary rays should end at the ducts, and not be flattened around them, as I have found to be the case in all specimens so far examined. In the section before mentioned

the cambium layer is but two or three rows of cells in advance of the first row of ducts.

On treating the newly formed wood-cells with Indol, fourteen rows gave the so-called reaction for lignine, the indications being principally confined to the lamellæ joining the cells. In the most delicate tests for lignine with this reagent I find that in the older wood-cells the lamellæ joining them give the most decided reaction; in fact, some woods, especially the bast fibres, give a reaction upon applying the proper acid before adding the Indol.

In regard to the arrangement of the ducts in the completed annual growth, we see that as the wood-cells grow and the ring thickens, the ducts are inclined through the ring becoming smaller and smaller until in the outer portion in this wood they are but little larger than the ordinary wood-cells. This last feature is only true of some of the Angiosperms; in others the ducts are practically the same size in all parts of the ring.

Surrounding both the large and small ducts are series of small tracheids, their thin places being very small and delicate. Interspersed among the ordinary wood-fibres are cells which, in the alburnum, are filled with starch during a portion of the year. In some instances they are provided with septa, in others they appear like round-ended cells one above the other. In transverse sections, these are seen to be arranged in irregular rows at right angles to the medullary rays, so that the wood is divided off into small rectangles of three to four rows of cells on a side surrounded by starch-carrying cells on all four sides. The function of these latter cells is not fully explained, but for a portion of the year they serve the purpose of storehouses for reserve material. In the specimen cut on the 1st of May the cells seem more densely packed than in any others that I have examined cut in the months from September to the present time. Later, when the tree has developed its leaves and flowered, I expect to find these cells nearly or quite empty.

Wood of the White Oak cut on the same date had one row of ducts formed and many rows of wood-cells. The Hemlock had not formed any wood-cells. Branches taken on May 9th from the Horse Chestnut, and also from Lilacs which were in full leaf and flower, had only traces of starch in the medullary rays.